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United States Patent [19]

Marsh

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[54] **LAMINAR FLOW VERTICAL JET STREAM NOZZLE WITH OVERHEAD STREAM CAPTURE**

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[51] **Int. Cl.**^{7} **B05B 17/08**

[52] **U.S. Cl.** **239/17**; 239/20; 239/499; 239/518; 239/524

[58] **Field of Search** 239/16, 17, 18, 239/20, 499, 518, 524

[56] **References Cited**

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3,785,559	1/1974	Hruby, Jr.	239/17
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4,892,256	1/1990	Brown et al.	239/524 X
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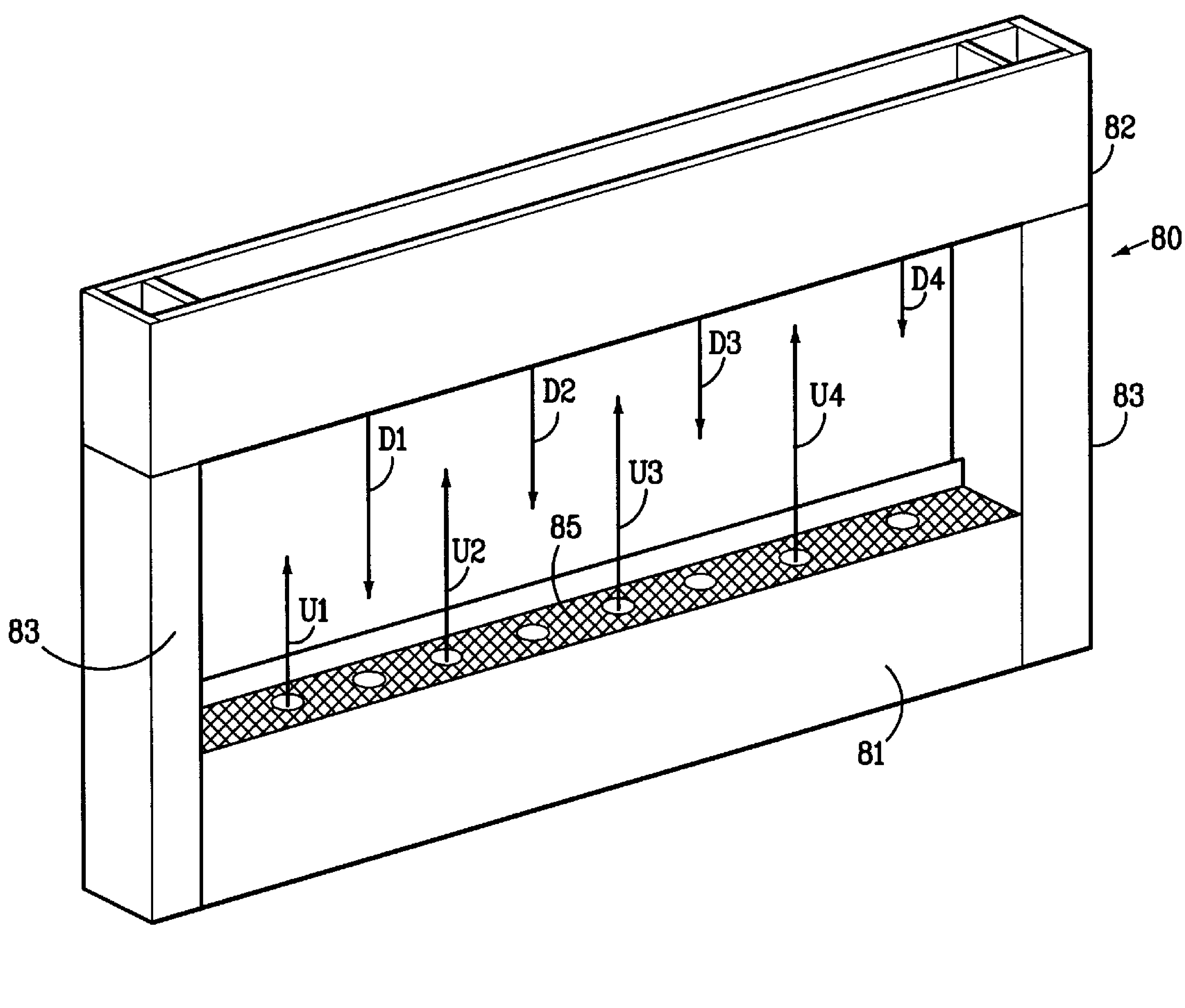
Primary Examiner—Lesley D. Morris
Attorney, Agent, or Firm—Maxwell C. Freudenberg; Kenton L. Freudenberg

[57] **ABSTRACT**

A laminar flow liquid stream nozzle having capability of being mounted to project a stream in any direction including directly overhead and including a stream capturing device for making the stream seem to disappear when projected overhead. The nozzle is selectively capable of momentary stream bursts or timed periods of projection from short periods to continuous stream flow. A structure of multiple such nozzles is provided having at least two banks of oppositely located spaced receptacles with essentially linear laminar flow stream patterns each projected unidirectionally from a nozzle in one receptacle to a receiver in another receptacle. The structure may include vertical linear stream patterns. These patterns may include parallel laminar jet streams and some may be projected straight up. Turning a vertically directed stream "off" may be achieved by a splitting water spray which causes split stream portions to be intercepted by surfaces within the nozzle near the normal "on" laminar flow stream path. Drip guides are provided on the intercepting surfaces to prevent residual or collected water droplets existing on these surfaces during "on" periods from falling into the path of and disturbing the appearance of the "on" laminar stream.

21 Claims, 10 Drawing Sheets



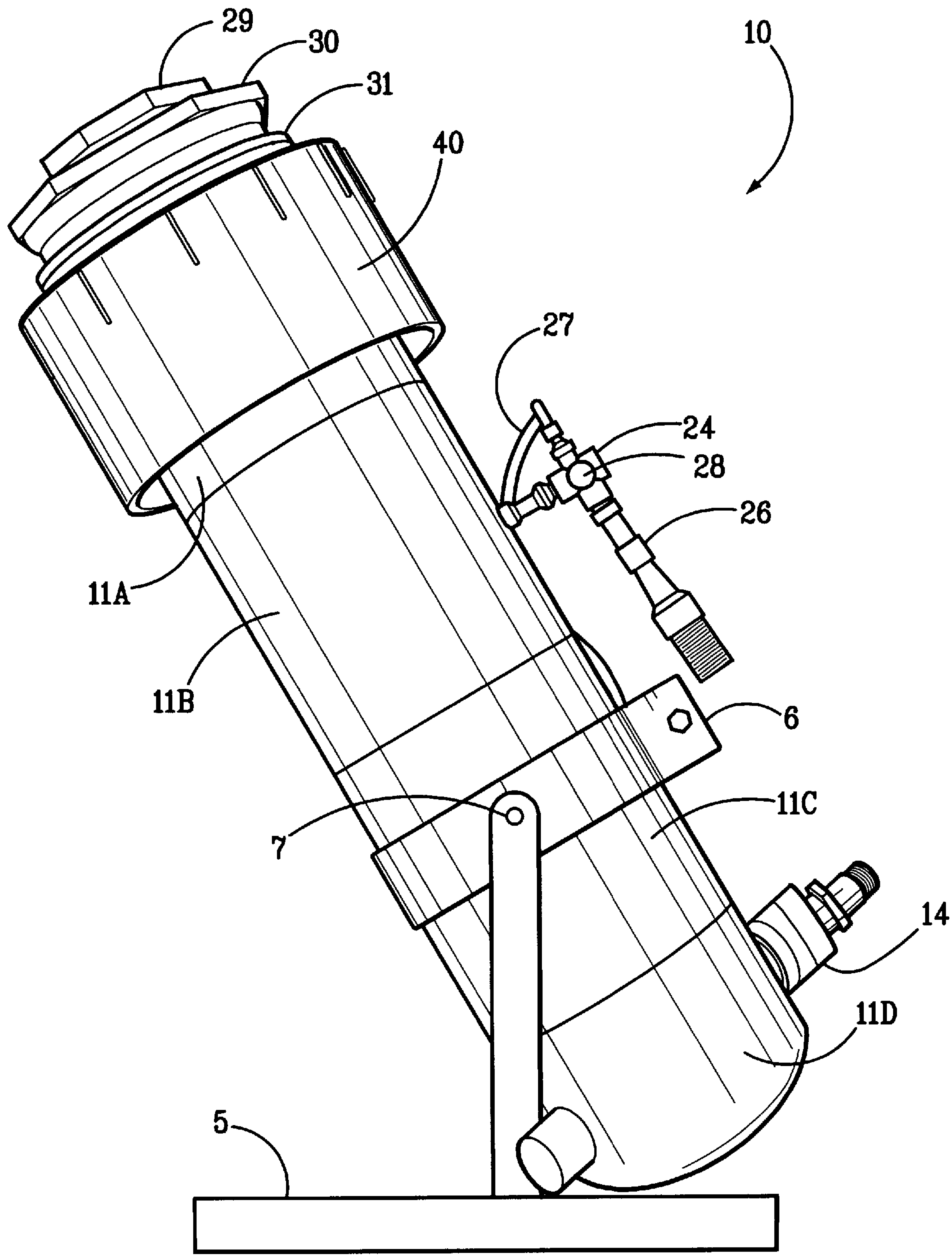


FIG. 1

FIG. 2

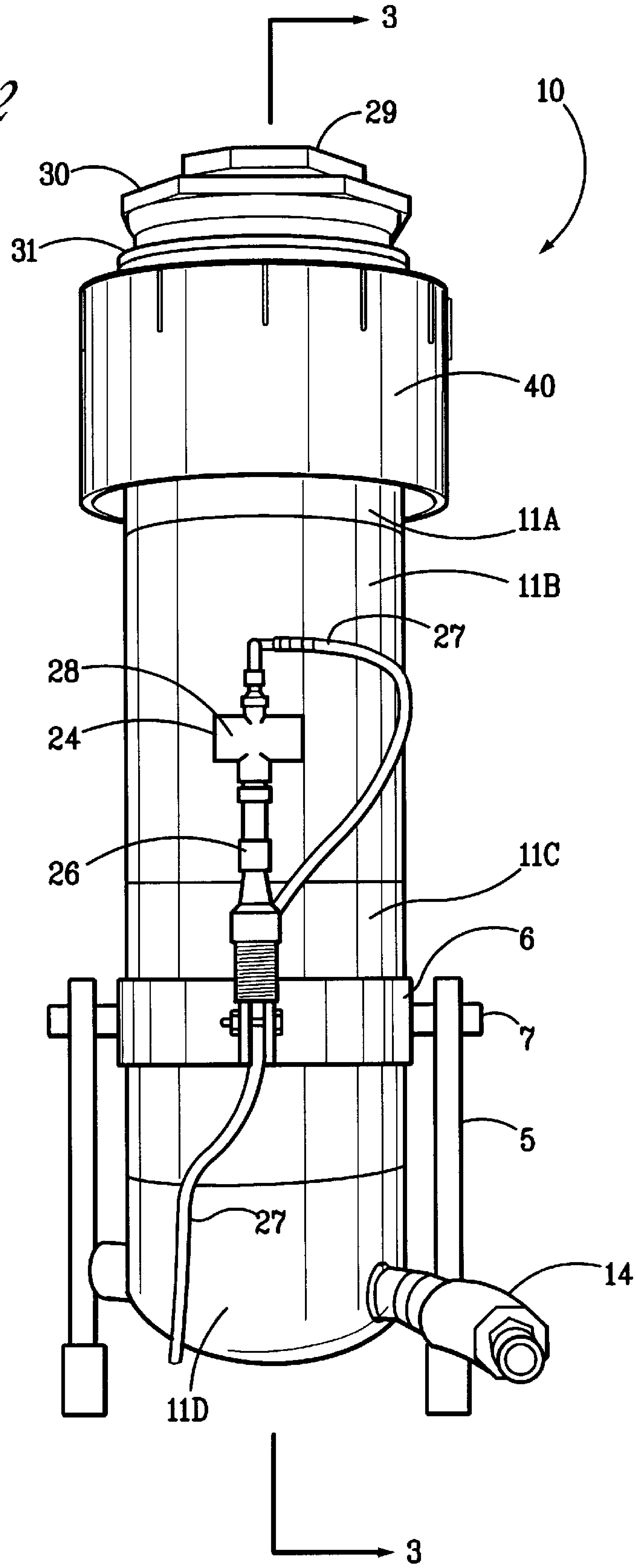
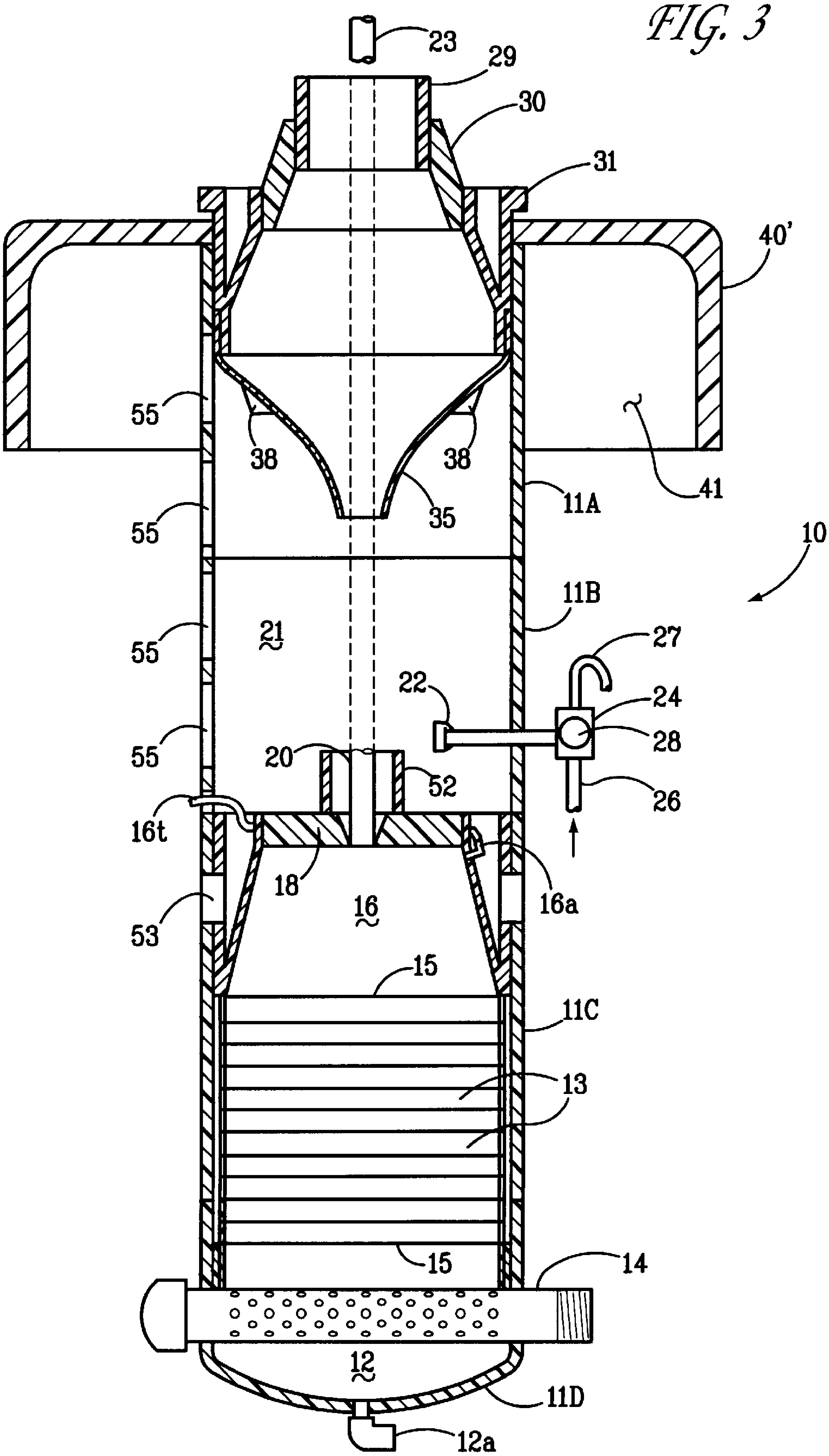


FIG. 3


23
29
30
31
40'
55
38
38
35
41
11A
10
11B
21
27
22
24
28
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52
26
16t
18
16
16a
53
15
11C
13
15
14
12
11D
12a

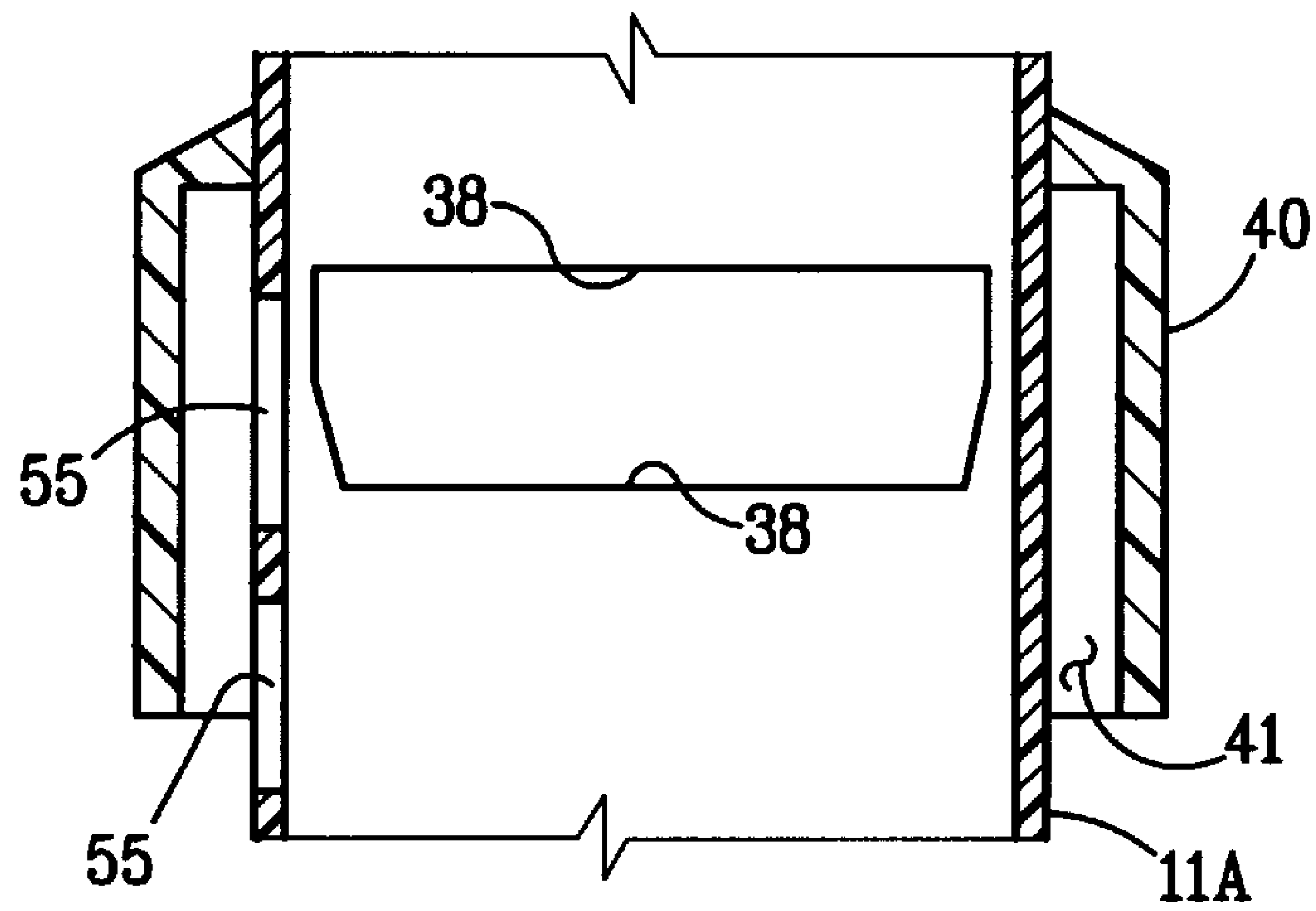

38
38
40
55
41
55
11A

FIG. 3A

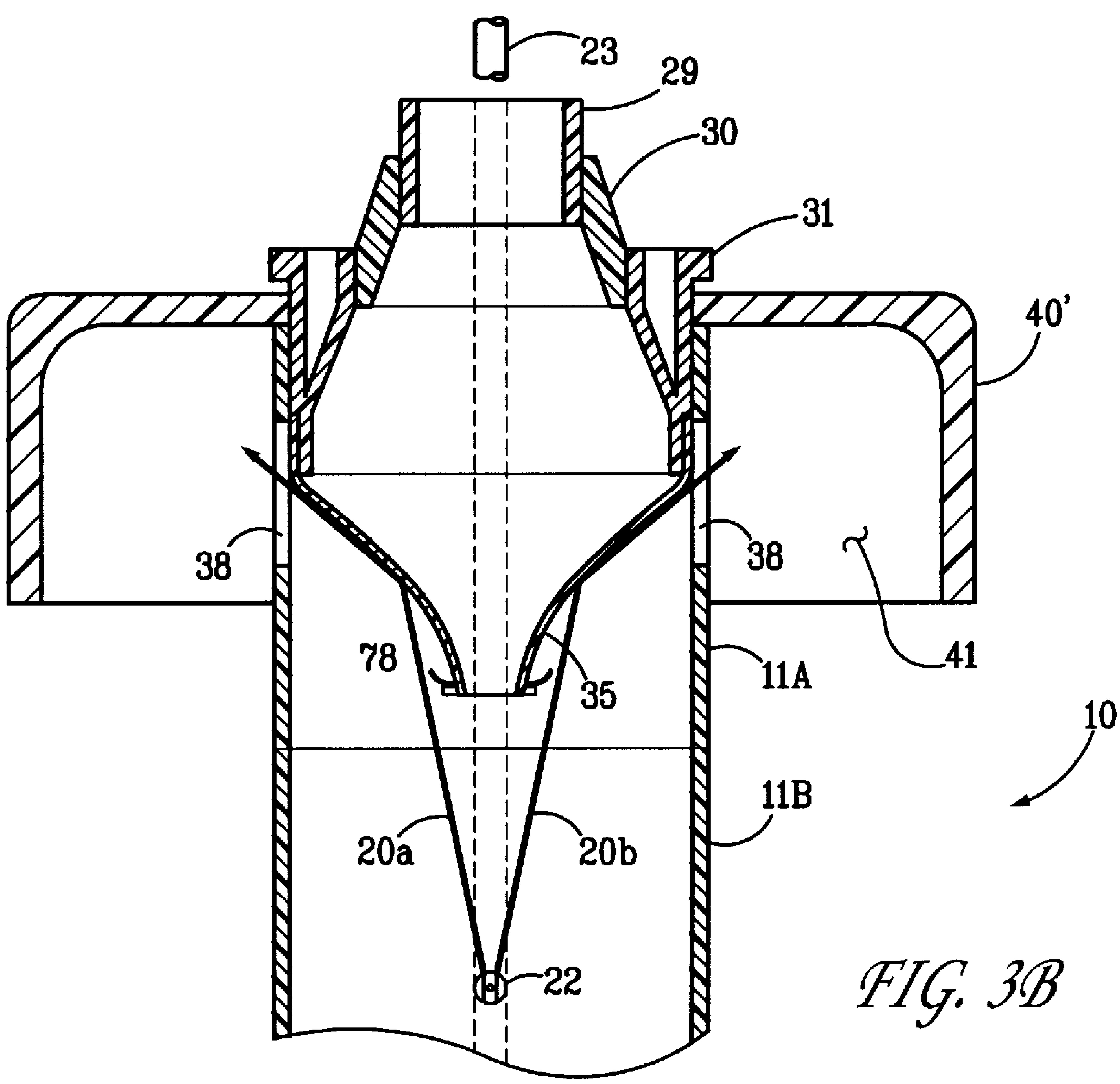

23
29
30
31
40'
38
38
41
78
35
11A
10
11B
20a
20b
22

FIG. 3B

FIG. 4B

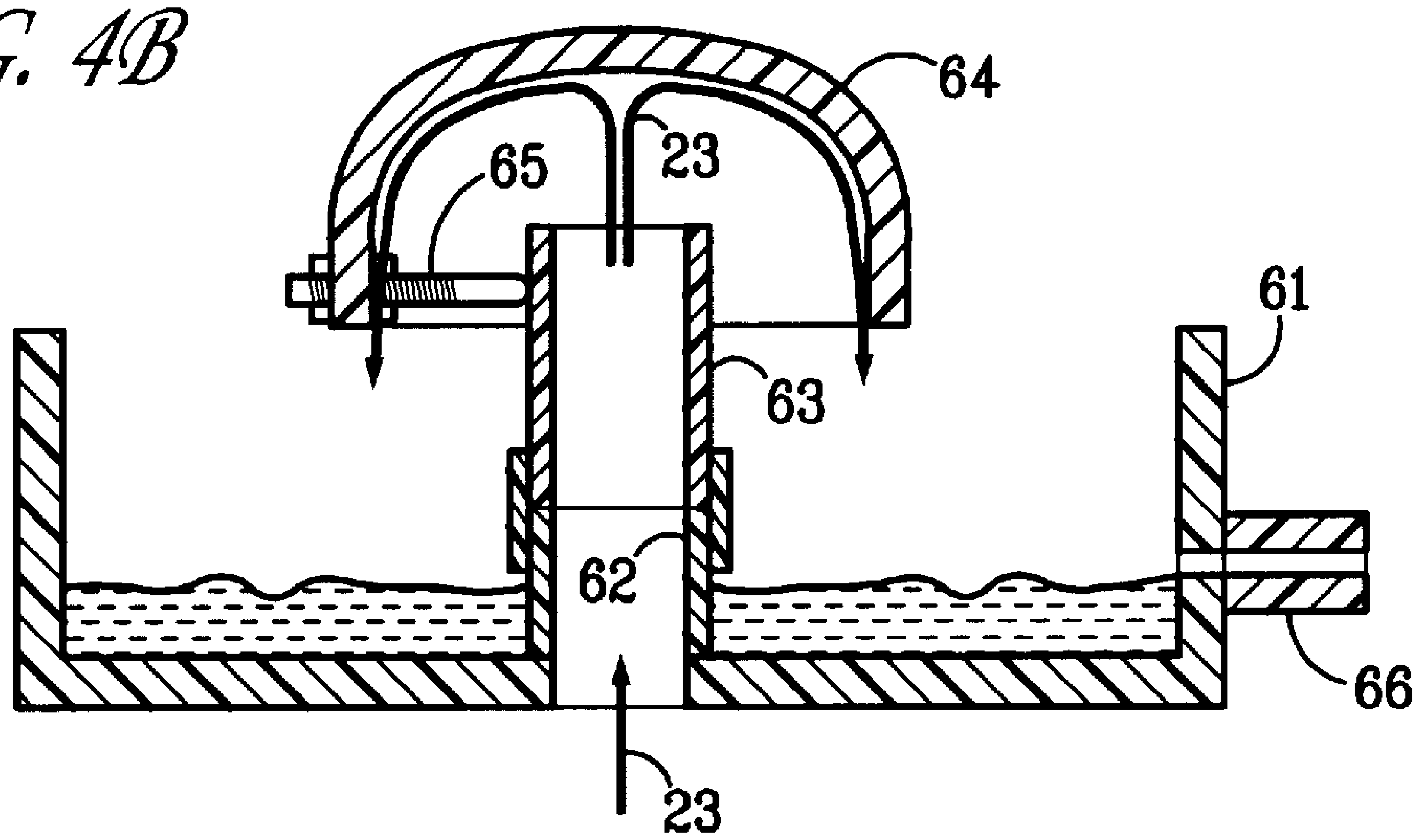


FIG. 4A

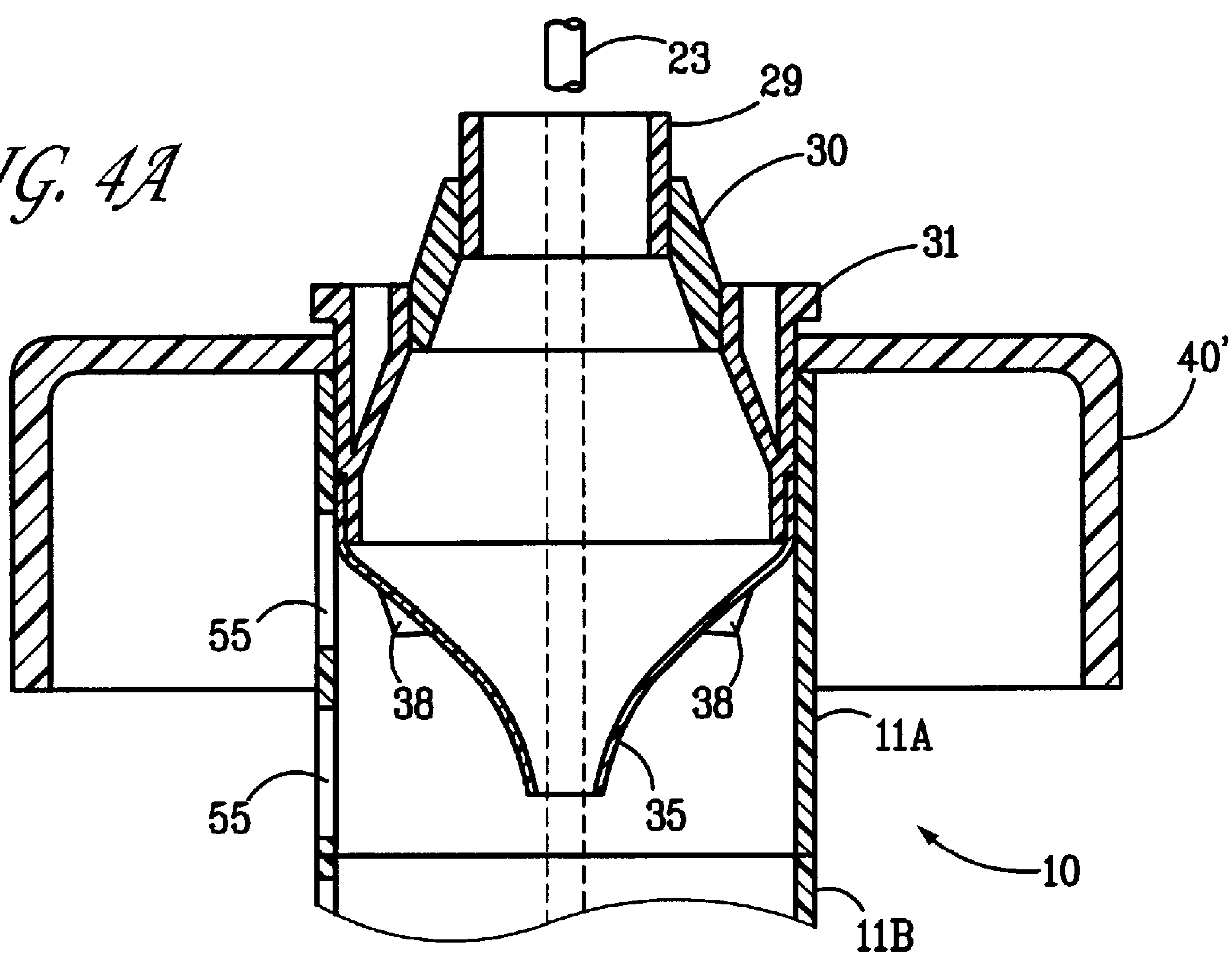


FIG. 5

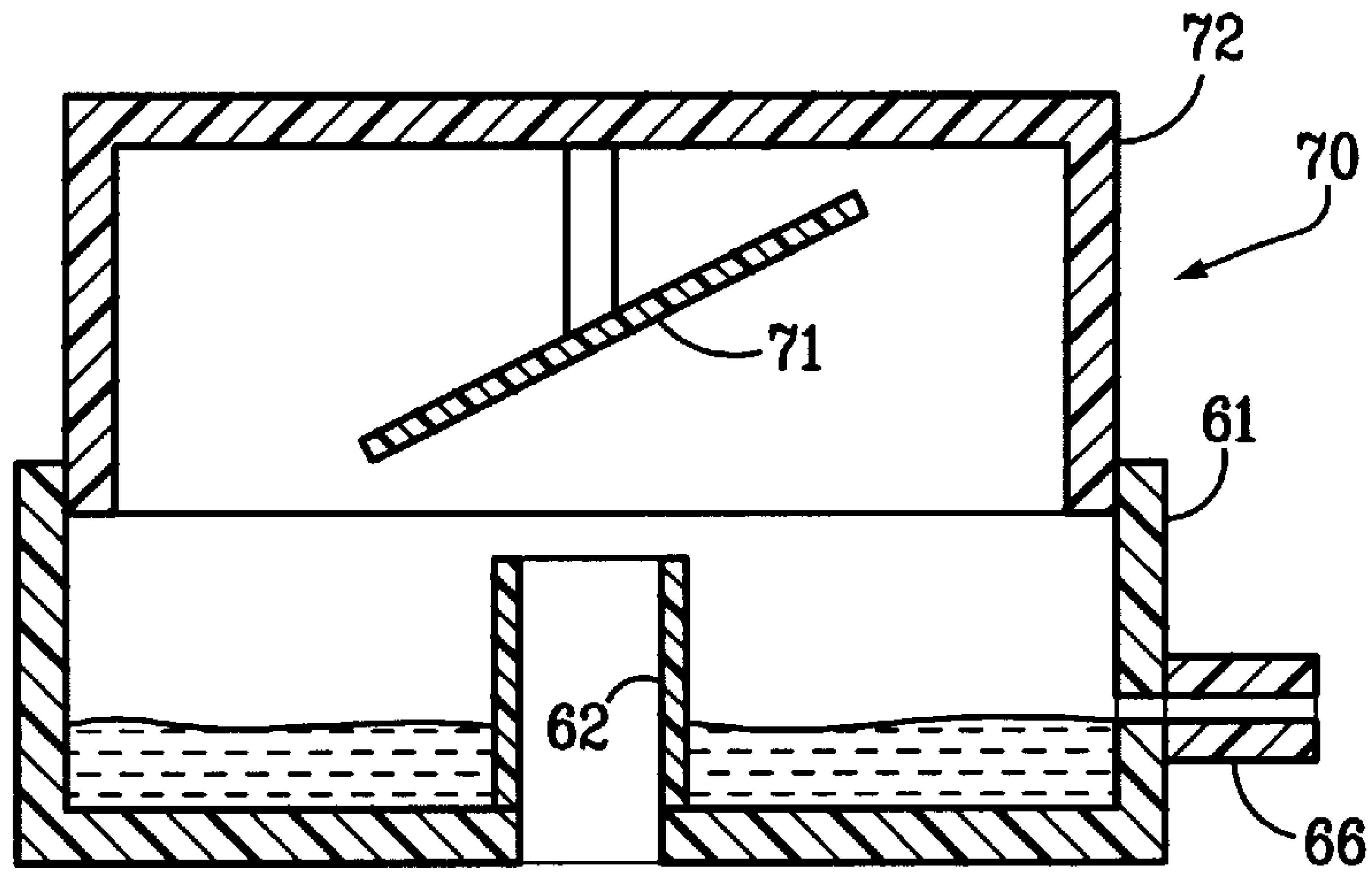


FIG. 6

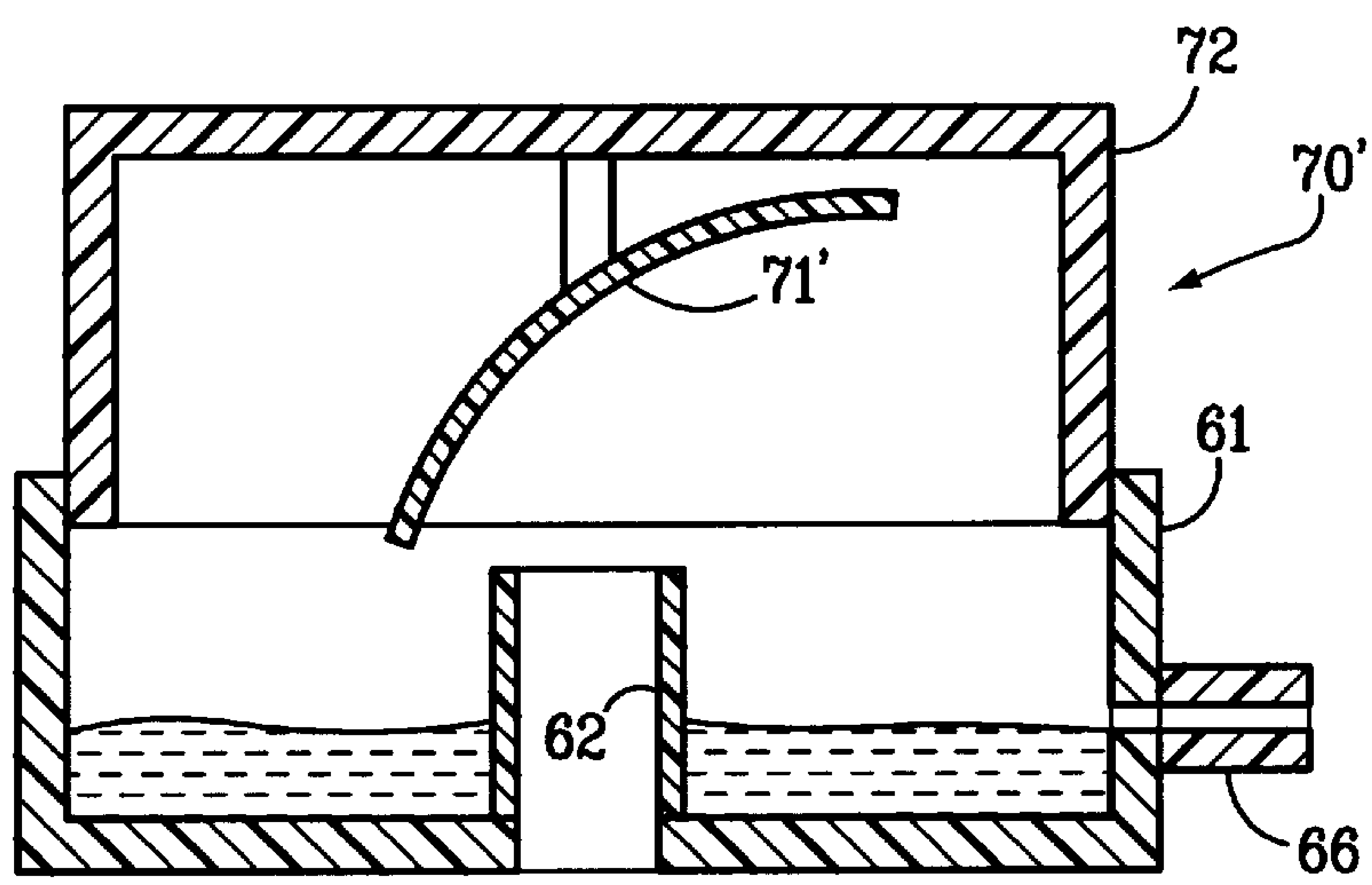
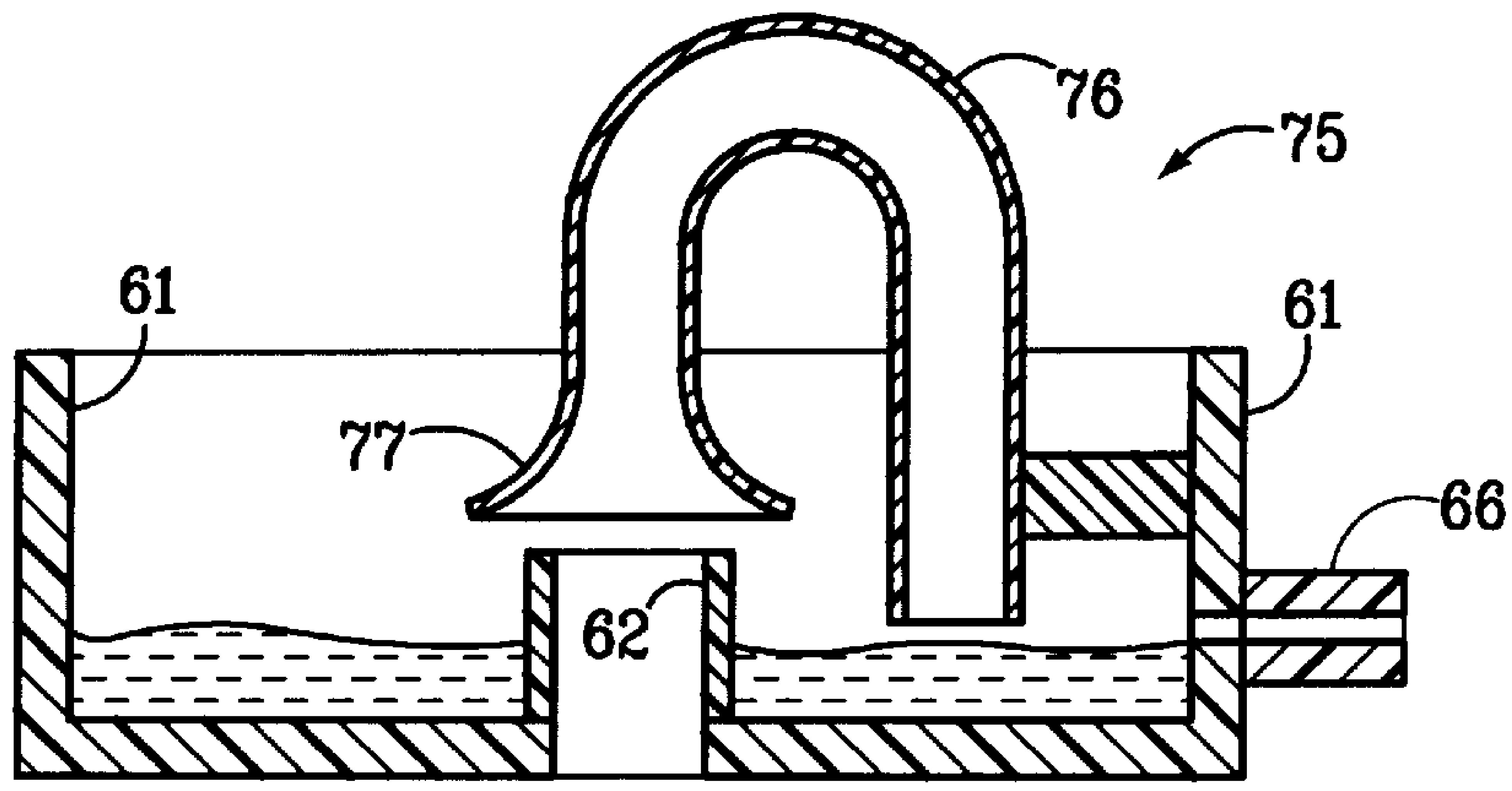


FIG. 7



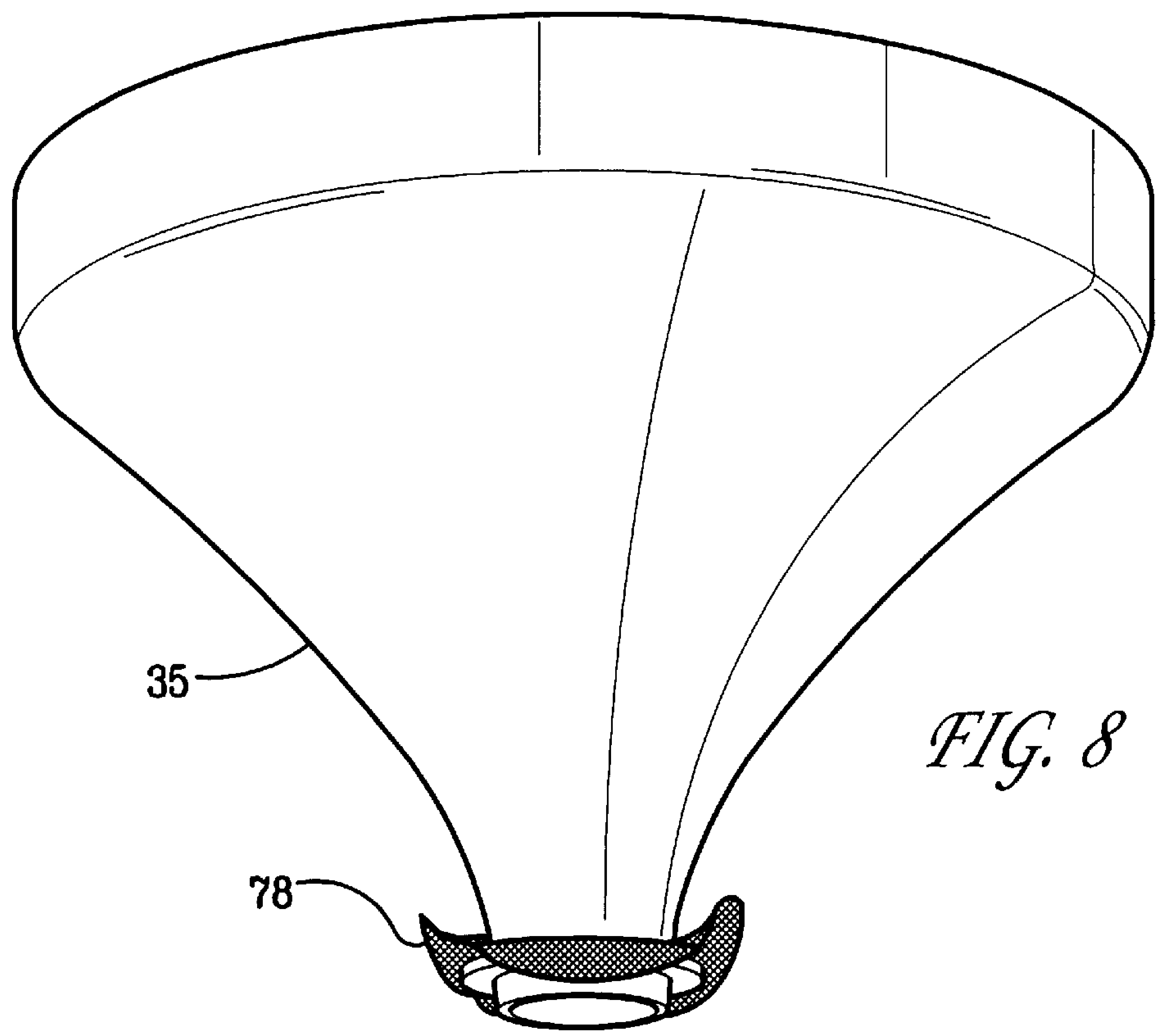


FIG. 8

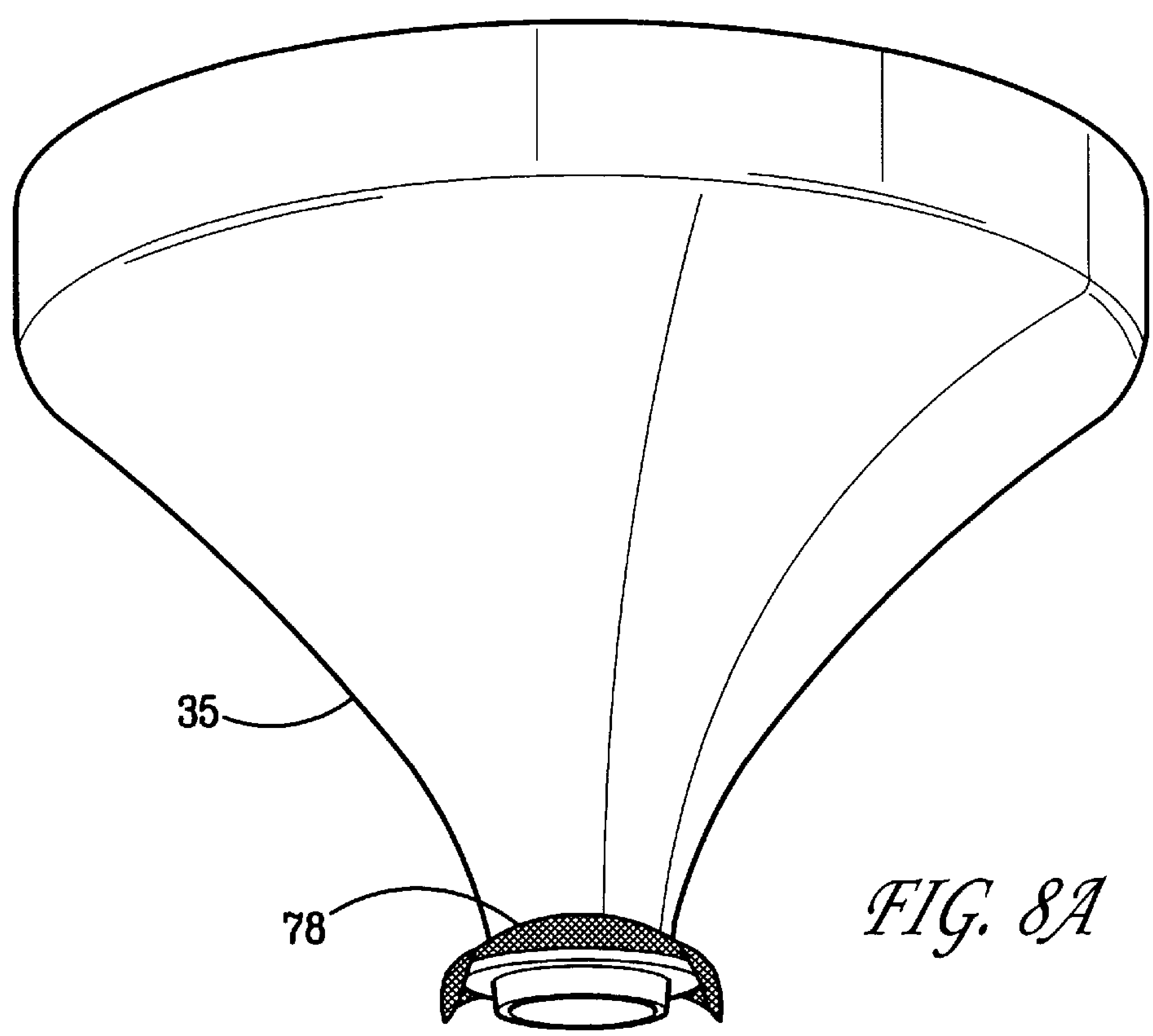


FIG. 8A

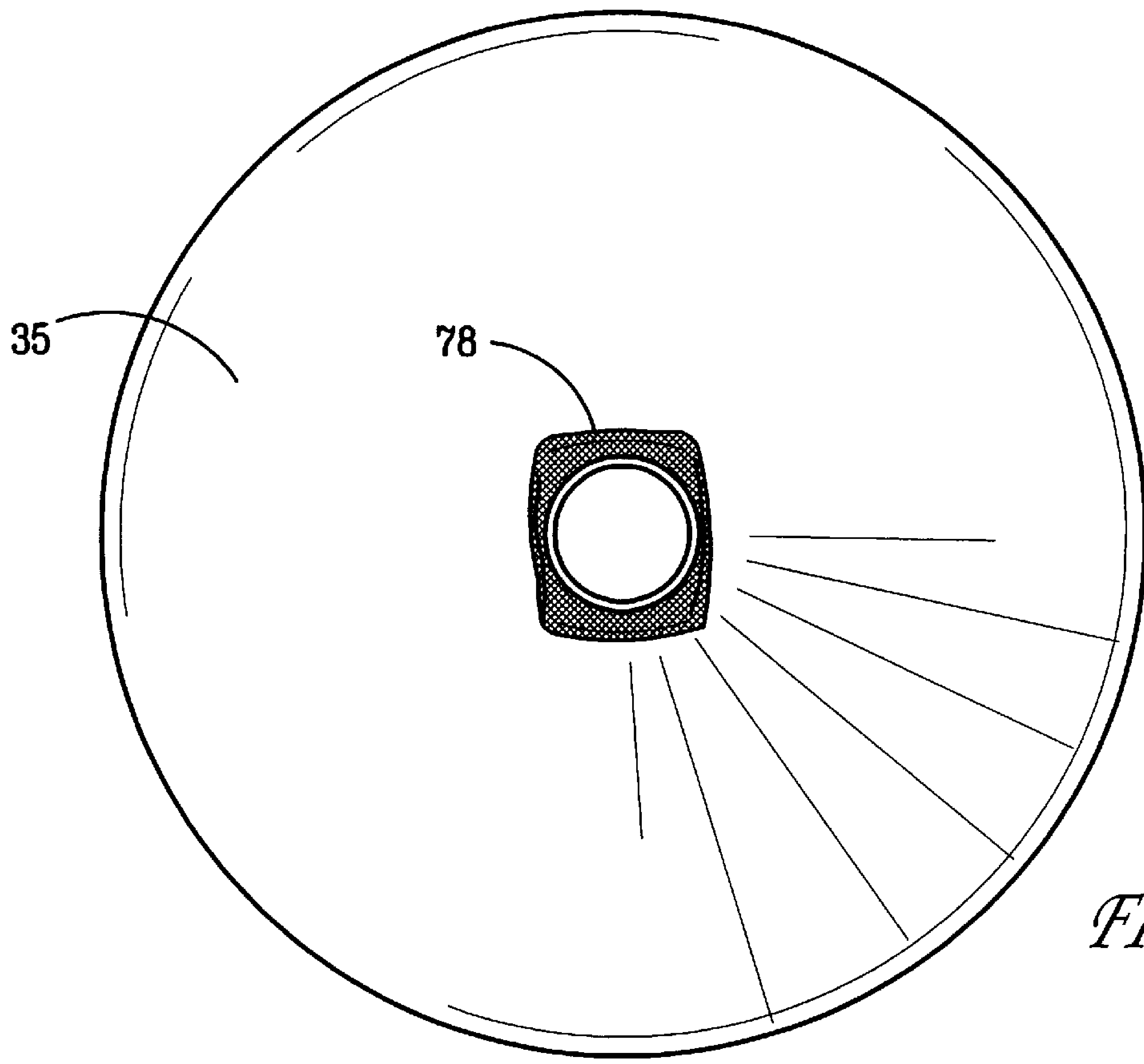


FIG. 9

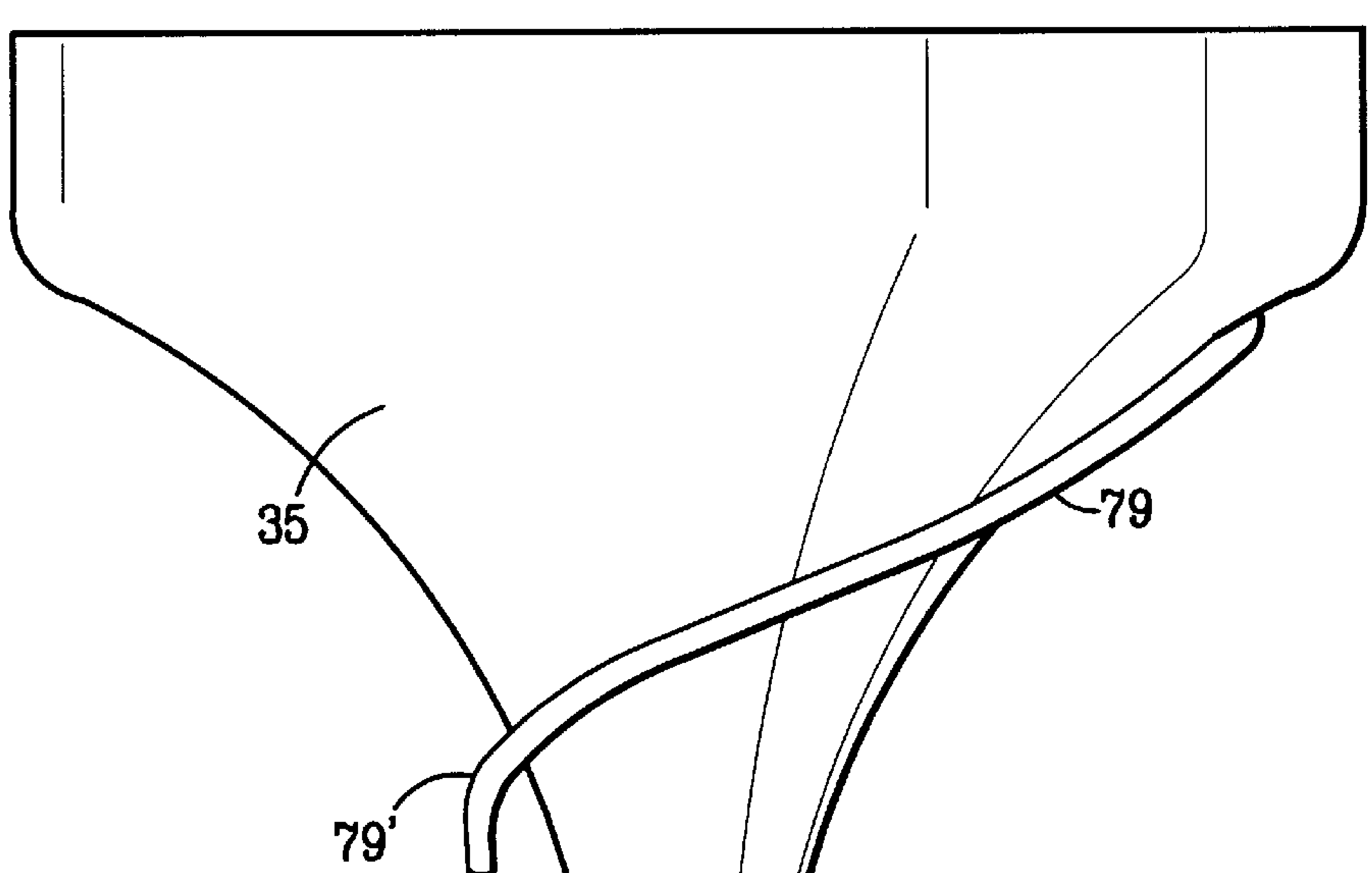


FIG. 10

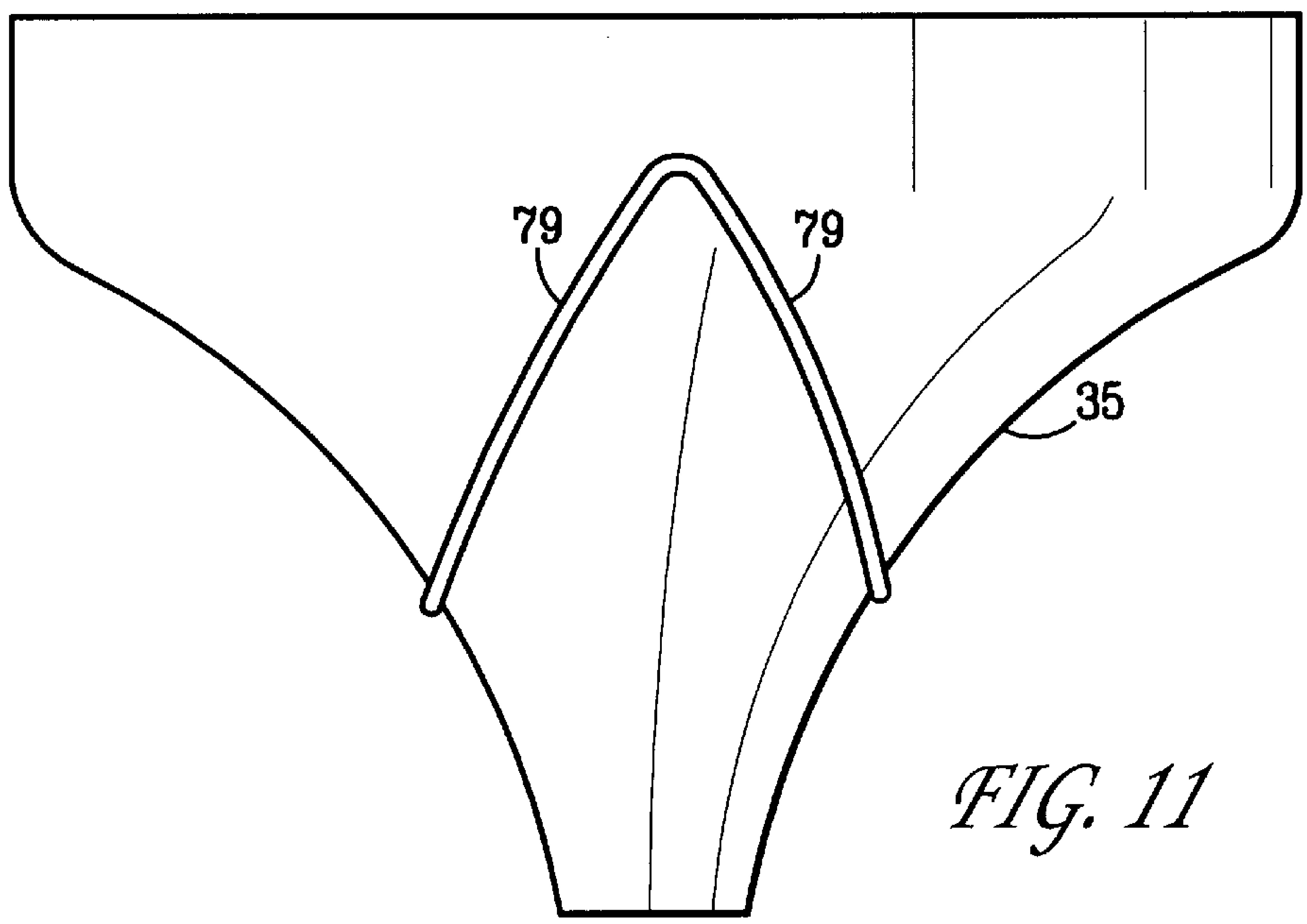


FIG. 11

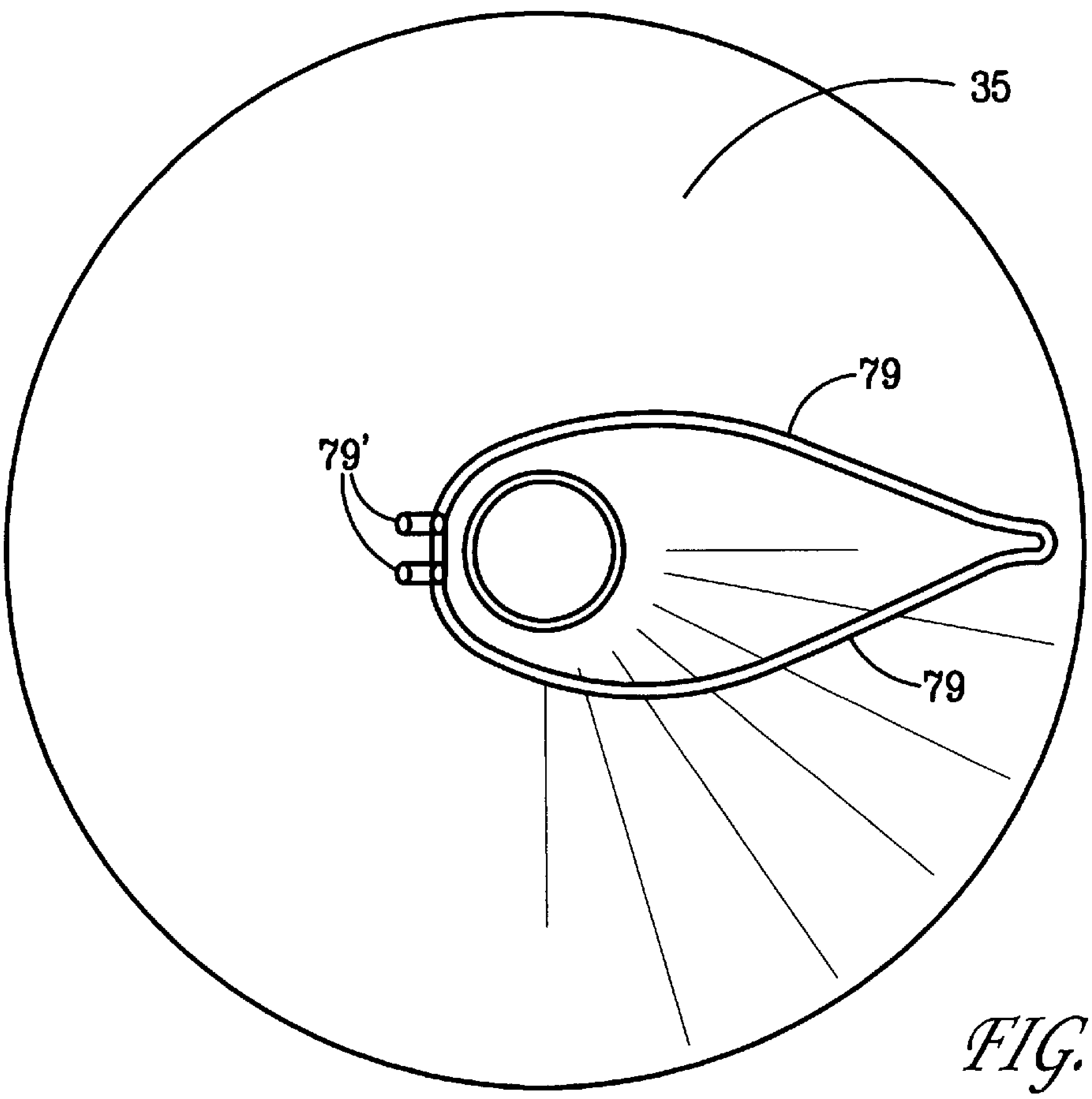


FIG. 12

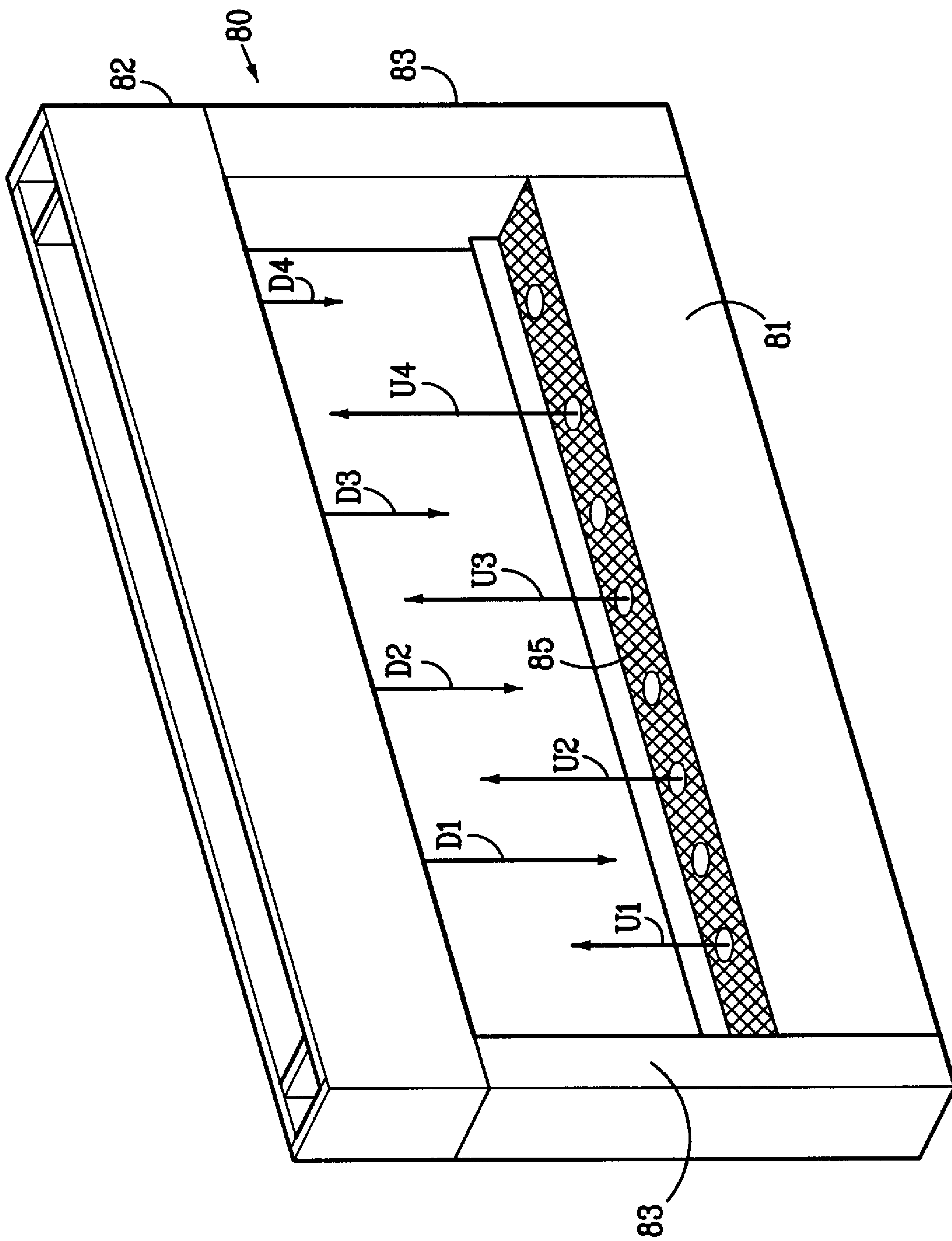


FIG. 13

LAMINAR FLOW VERTICAL JET STREAM NOZZLE WITH OVERHEAD STREAM CAPTURE

This invention relates to jet stream nozzle apparatus for generating and projecting a selectively and intermittently interruptable glass-rod-like laminar flow water stream in any direction from a projection point to a receiving point. These points may be vertically spaced and in different mutually spaced structures. Continuous or intermittent sections of the laminar stream have an appearance similar to a smooth glass rod.

BACKGROUND OF THE INVENTION

Several devices for projecting an inclined laminar stream in a direction outwardly and upwardly at substantial angles from both the vertical and horizontal directions are shown and described in the following patents: U.S. Pat. No. 3,630, 444 (FIG. **6**), U.S. Pat. Nos. 4,795,092, 4,889,283, 4,995, 540, and 5,160,086. In these devices no part of a projected laminar flow stream flows directly vertically either up or down and no part of a stream returns to the vicinity of the nozzle orifice from which it issues and thus pose no interfere problem with a subsequent U.S. Pat. No. 4,889,283 controllably interrupts the projection of the stream by splitting it with a flat knife-like spray of water to divert the stream portions to inverted catch basins on opposite sides of the normal projected stream path. Another patent U.S. Pat. No. 5,161,740 shows and describes a "pop jet" type fountain device for projecting vertically from a laminar flow producing orifice momentary bursts of water which flow through a secondary pool to pick up additional water and air bubbles to form "amoeba" shaped surface-tension envelopes or "balls" of water which for vertical projection presumably, though not described, completes an up and return "cycle" before the next "ball" of water is shot up. Otherwise the returning water would interfere with the ensuing upward projection. U.S. Pat. No. 3,151,811 shows a non-laminar flow conical fountain projecting multiple divergent spray portions upwardly into an area where they move outwardly and fall by gravity into an elevated annular trough.

SUMMARY OF THE INVENTION

The present laminar jet stream system is capable of being arranged to project a laminar jet stream either continuously or programmably intermittently in any direction including directly vertically up or down.

In describing the present invention the term jet stream is intended to refer to a conspicuously observable continuous or intermittent laminar flow stream of water having an essentially round cross section and a smooth appearance like that of a smooth glass rod. The round or rod-like configuration is determined by a round discharge orifice from a pressurized non-turbulent laminar flowing water body and by surface tension of the water. The effects of gravity come into play to slightly change the round cross section essentially only for projection which is not straight up or down. Slow moving or stagnant droplets and other residual water in the system may be referred to as spent or low energy liquid as distinguished from the relatively faster high energy liquid in the laminar flow jet streams and the splitting sprays.

It is an object of the present invention to provide a laminar flow jet stream system in which a nozzle structure can be arranged to project a continuous or intermittent jet stream in any direction.

Another object of the present invention is to provide a jet stream nozzle system in which the direction of projection of

a jet stream can be selectively changed from vertically upward to vertically downward.

Another object of the invention is to provide a jet stream system in which vertical upward projection of a jet stream can be maintained independently of duration of the jet stream flow.

Another object of the invention is to provide an improved diverter system for selectively diverting the flow of a laminar stream in a nozzle device before it is projected as an external jet stream.

Another object of the present invention is to prevent drops of water collecting on portions of the diverter system during operation of the nozzle device from dropping by gravity into the path of and disfiguring a laminar flow jet stream of water being projected.

Another object of the present invention is to prevent drops of water collecting on portions of the diverter system during operation of the nozzle device from dropping by gravity to interfere with the smooth appearance of a laminar flow jet stream of water being projected.

A further object of the invention is to achieve a laminar flow nozzle system having an eye-catching effect utilizing multiple jet streams which are projected straight and seem to disappear.

The present invention has the capability of projecting a laminar jet stream in any direction. When projected straight up the stream can be captured by means forming part of the invention so as not to disruptively fall back into itself. The outside of the diverter against which split stream portions are directed has a curved flare and has drip guides on its outer surface near its lower curved entry end to prevent droplets on the outer side of the diverter from falling into a jet stream flowing through the diverter. The present inventor has used as prior art a straight sided diverter cone with no means for drip control.

DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side view of a nozzle device according to the present invention pivotably mounted at an inclined angle on a adjustable pivot supporting frame.

FIG. **2** is a view from the right side of the nozzle device of FIG. **1**.

FIG. **3** is a section of the nozzle device taken on the vertical centerplane line **3**—**3** of FIG. **2** and showing a conical jet stream interceptor and diverter, but with an annular shield larger than in FIGS. **1**–**2**.

FIG. **3A** is a section of part of the nozzle device of FIG. **1** and similar to FIG. **3** with the conical split stream interceptor omitted showing a complete exit window for escape of a diverted split stream portion.

FIG. **3B** is a section view of part of the nozzle device of FIG. **3**, but taken on a plane perpendicular to that of FIG. **3** and containing the nozzle device axis and looking at the splitting nozzle to show the respective liquid paths after the jet stream is split with the deflected split stream portions moving outwardly through respective exit windows.

FIG. **4A** is a partial vertical section of a preferred embodiment of the invention which incorporates a system for vertical upward projection of a jet stream using a nozzle device like that of FIGS. **1**–**3**, but vertically oriented and for simplicity showing in section, taken along the axis of the device like the view of FIG. **3** and showing only the upper stream exit portion of the nozzle device above a point of jet stream splitting.

FIG. **4B** is a partial vertical section and shows in section the orientation above the nozzle device of a cooperating catching, diverting and retaining device to be fixed above the exit portion of the nozzle device of FIG. **4**A for capturing a vertically projected jet stream.

FIG. **5** is a vertical section in the same axial plane corresponding to FIG. **4**B of an alternative embodiment of a jet stream catching, diverting and retaining device.

FIG. **6** is a vertical section in the same axial plane corresponding to FIG. **4**B of another alternative embodiment of a jet stream catching, diverting and retaining device.

FIG. **7** is a vertical section in the same axial plane corresponding to FIG. **4**B of still another alternative embodiment of a jet stream catching, diverting and retaining device.

FIG. **8** is a side perspective view of a conical split stream diverter oriented generally as seen in FIG. **3**B and showing a drip guide around the entrance opening of the diverter.

FIG. **8**A is a side perspective view of the conical split stream diverter as seen perpendicular to FIG. **8** and showing the drip guide around the entrance end of the diverter.

FIG. **9** is an axial underside view of the conical split stream diverter of FIG. **8**A showing the drip guide encircling the diverter with its dripping periphery radially outwardly of the jet stream entrance.

FIG. **10** is a view of an alternative embodiment to the conical split stream diverter as seen in FIG. **8**A and showing a drip guide ridge on one side of the diverter with drip ends offset horizontally relative to the stream entrance opening of the diverter.

FIG. **11** is a view of a conical split stream diverter of FIG. **10** as seen perpendicular to FIG. **10** and showing drip guide ridges on both sides of the diverter.

FIG. **12** is an axial underside view of the conical split stream diverter of FIGS. **9**–**10** showing the drip guide encircling the diverter with its dripping or droplet guiding surfaces radially outwardly of and at opposite sides of the jet stream entrance.

FIG. **13** is a perspective view of a jet stream display system using a plurality of jet stream nozzles and jet stream capturing devices in accordance with the present invention for projecting multiple independent vertical interruptable jet streams projected both upwardly and downwardly.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A nozzle device **10** for projecting a laminar flow jet stream is shown in FIG. **1** adjustably pivotably mounted at an angle of 60° to the horizontal by means of a stationary frame support **5** carrying a pivotable frame member **6** clamped to the casing of nozzle **10**. The pivotable frame member **6** is adjustably clamped by suitable means (not shown) to the stationary frame support **5** to enable the nozzle to be adjusted to any desired position of use from straight up to straight down. The lower portion of the nozzle can be swung clockwise down about the pivot axis **7** within the frame **5** to point the nozzle straight up. By properly configuring the frame **5** for no interference with the nozzle the upper end of the nozzle **10** can be swung 150° counterclockwise from the FIG. **1** position to point straight down. In such swinging movements the splitting nozzle and its valve **24** remain at the top side of the nozzle device casing because there are several drain openings **53** and **55** in the other side of the nozzle casing which should preferably be kept at the lower side of the casing.

As seen in FIGS. **1**–**3** the nozzle device **10** comprises an elongated cylindrical PVC canister or casing of generally round cross section and formed by several like-diameter cylindrical portions **11**A, **11**B and **11**C connected end-to-end and to an inverted dome-like or cup member **11**D at the lower end. A first or lower end portion of the nozzle device formed by the cup member **11**D contains an input chamber **12** which is supplied with water from a continuously pumped pressurized source (not shown) including a reservoir tank for collected recirculating water from nozzle operation and having water level control for admitting additional water as needed from a typical main through a conventional water softening and demineralizing unit. The pressurized source includes a pump for pumping water from the tank to an inlet end of pipe **14** which extends into and diametrically across the input chamber **12**. The other end of pipe **14** is capped. The pipe **14** is uniformly perforated on all sides along the entire portion within the chamber **12** to provide good distribution of water across the input chamber **12** as a first step in reducing turbulence of water flowing through the nozzle **10**. The pressurized water is forced from chamber **12** through a stacked arrangement of turbulence reducing pad-like disk members **13** held between stationary rigid non-air-trapping perforated thin stainless steel plates **15** at opposite ends of the stack. The pads **13** are ½ inch thick and are made of a random pattern of overlapping vinyl loops of small diameter which form a multitude of free-flowing convoluted passages through the pads **13**. After passing through the stacked pads **13** the water reaches a laminar flow state in a chamber **16** where upon flowing through a round sharp edged orifice at the center of the lower face of a jet forming plate **18** it is formed into an essentially turbulent free laminar flow stream **20** having the appearance of a glass-like rod and projected coaxially of the nozzle device axially into or through a splitting or diverting chamber **21**.

To eliminate air in chamber **16** when the nozzle device points up as in FIGS. **1**–**3** an air bleed connector **16***a* at the top of chamber **16** allows the escape of trapped air. The connector has an outlet tube **16***t* for discharging water and air to the other side of the nozzle device. Similarly when the nozzle device is inverted to point down, another such air bleed connector **12***a* is connected to a central high point of the inlet chamber **12**.

Unless acted upon by a splitting spray from nozzle **22** in chamber **21**, the stream **20** continues axially of the nozzle device **10** from which it emerges as a laminar flow jet stream **23** from a coaxial sleeve **29** at the upper or second end of the nozzle device **10** with sufficient velocity to perform attractive and pleasing display actions as described hereinafter. The sleeve **29** is anchored in the upper end of a cylindrical casing portion **11**A by size reducing adapters **30** and **31**. The 7/16 inch diameter of the orifice in plate **18** together with the flow rate and pressure of water supplied to the inlet pipe **14** determine the path of jet stream **23**. This path and the laminar flow character are also affected by gravity and the direction in which the nozzle device is pointed.

When any stray spray or residual drops of water move down the inside of the nozzle device **10** and onto the upper surface of the jet stream forming plate **18**, such moisture is kept from flowing into the diverging or conical aperture above the sharp edge at the stream forming aperture by a dam **52** which retains or guides any water on the top of plate **18** to drain off through a hole **53** in a side wall or casing portion of the nozzle **10**.

The spray from splitting nozzle **22** is preferably a flat knife-like spray of water projected in a plane containing the axis of the stream **20** and capable of splitting the stream **20** into two portions **20**A and **20**B as seen in FIG. **3**B which move past the drip guide **78** on the lower end of the conical diverter **35** and move upwardly and outwardly along the upper sides of the diverter. The splitting spray from nozzle **22** is actuated by a fast-acting solenoid operated valve **24** having a pressurized water inlet line **26** connected to the sane pressurized water source (not shown) which feeds the inlet pipe **14** for the nozzle device **10**. The valve **24** has a normally-open discharge to the splitting nozzle **22** which keeps the laminar jet stream split or "off" when the solenoid **28** is not energized. Energization of the solenoid **28** actuates the valve **24** by means of which all water through the valve **24** flows to a bypass connection **27** and the pressurized splitting water supply bypasses the splitting nozzle **22** and is returned to the aforementioned water tank for recirculation. Any suitable control mechanism may the valve to stop supply of splitting spray from nozzle **22** momentarily, for different timed periods or continuously to cause the stream **20** to be projected for respective periods of time producing short bullets of flow, longer variable length rods of flow or a continuous rod-like laminar flow stream flowing between the nozzle **10** to any appropriate receiver or destination point.

When the stream **20** is split as seen in FIG. **3**B, the portion **20**A is directed to the left in FIG. **3**B and away from the reader in FIG. **3** to move in spaced relationship past an open relatively pointed lower or entry end of a cone-like interceptor diverter **35** and upon striking the outer surface of the diverter **35** be directed upwardly and outwardly along the surface of the diverter and then through a respective arcuate window **38** at one side of the nozzle **10**. Similarly the other split portion **20**B strikes the other side of the cone-like diverter **35** and is directed through the opposite arcuate window **38**. Each of the windows extends about 125° around a cylindrical wall portion **11**A of the nozzle device **10**. As seen in FIG. **3**A, an annular shield **40** (of FIGS. **1** and **2**) intercepts the outwardly directed split streams **20**A and **20**B. Upon striking the shield **40**, or the larger diameter shield **40**' in the embodiment of FIGS. **3** and **3**B, the water of streams **20**A and **20**B falls from the bottom of the chamber or space **41** between the wall portion **11**A and the shield **40** or **40**' and can exit this chamber to be conducted by any suitable means back to the aforementioned tank for supply to the pressurized water source for recirculation. The shield **40**' of FIGS. **3** and **3**B surrounding wall portion **11**A, is of less height, and of greater diameter than the shield **40** illustrated in FIGS. **1**, **2** and **3**A. This is advantageous for vertical stream projection of several feet where the amount and velocity of diverted or split water may be increased.

Above the nozzle device **10** as oriented in FIG. **4**A for vertical projection of the jet stream **23**, the stream **23** disappears by being captured within a cooperating relatively fixed catching, diverting and retaining device **60** seen in FIG. **4**B. This capturing device **60** includes a trough **61** supported by any suitable means in fixed relationship to the nozzle device **10** and having at an aperture in the bottom surface of the trough **61** an upstanding vertical cylindrical sleeve or dam **62** fixed and sealed therein and coaxially aligned with the nozzle device **10** to receive the stream **23**. Removably supported coaxially on the sleeve **62** is a taller cylindrical sleeve **63** which carries and extends into an inverted coaxial cup-shaped or dome-shaped member **64**. The member **64** is positioned and supported on the upper end of sleeve **63** by three uniformly spaced and angularly related screws **65** with the center of member **64** horizontal and generally perpendicular to the axis of the nozzle device **10** and the stream **23**. The capturing device **60** is fixed by suitable means, i.e. as in FIG. **13**, at a height above the nozzle device **10** such that the stream **23** is still a laminarly flowing stream and has sufficient energy that it will be deflected outwardly upon striking the center of the member **64** and flow along its inner surface to its outer depending walls where it is further deflected downwardly into the trough **61** and prevented from dropping back through the sleeve **63** and possibly interfering with the upward laminar flow of the stream **23**. When the stream **23** is interrupted, any residual drops of water on the inner surface of member **64** similarly run down its outer walls and drip into the trough **61**. Spent water from the stream **23** is returned for recirculation by any suitable means from a drain connection **66** at the bottom of trough **61** to the aforementioned tank of the pressurized source for the nozzle **10** system.

FIG. **5** shows a jet stream capturing device **70** alternative to the capturing device **60** shown in FIG. **4**. This capturing device **70** includes a trough **61** supported by any suitable means in fixed relationship to the nozzle device **10** and having at an aperture in the bottom surface of the trough **61** an upstanding vertical cylindrical sleeve **62** fixed and sealed therein and coaxially aligned with the nozzle device **10** to receive the stream **23**. In lieu of the cup **64** of FIG. **4**, this embodiment has a flat inclined plate **71** extending in all horizontal directions past the vertical sleeve **62**. A jet stream striking this plate is deflected outwardly to the walls of a box **72** which provides means to support the plate on the trough **61** and diverted water of the jet stream drains into the trough **61**. Any residual drops on the plate **71** after the stream **23** stops flowing merely flow down the lower face of the plate **71** where they drip off the lower edge of the plate into the trough **61**.

FIG. **6** shows a jet stream capturing device **70'** alternative to the capturing device **60** shown in FIG. **4** and mounted like the device **70** of FIG. **5**. This capturing device **70'** includes a trough **61** supported by any suitable means in fixed relationship to the nozzle device **10** and having at an aperture in the bottom surface of the trough **61** an upstanding vertical cylindrical sleeve **62** fixed and sealed therein and coaxially aligned with the nozzle device **10** to receive the stream **23**. In lieu of the cup **64** of FIG. **4**, this embodiment has a relatively flat inclined plate **71**' with a concave lower surface which extends in all horizontal directions past the vertical sleeve **62**. A jet stream striking this plate is deflected outwardly to the walls of the box **72** which provides means to support the downwardly concave plate **71**' on the trough **61** and diverted water of the jet stream drains into the trough **61**. Any residual drops on the plate **71**' after the stream **23** stops flowing merely flow down the lower face of the plate **71** where they drip off the lower edge of the plate into the trough **61**.

FIG. **7** shows a jet stream capturing device **75** alternative to the capturing device **60** shown in FIG. **4**. This capturing device **75** includes a trough **61** supported by any suitable means in fixed relationship to the nozzle device **10** and having at an aperture in the bottom surface of the trough **61** an upstanding vertical cylindrical sleeve **62** fixed and sealed therein and coaxially aligned with the nozzle device **10** to receive the stream **23**. In lieu of the cup **64** of FIG. **4**, this embodiment has an inverted U-shape pipe **76** of a diameter greater than the jet stream and having a first downwardly opening leg aligned coaxially with the sleeve **62** to receive the jet stream which passes up and around the base of the "U" and out the other leg into the trough **61**. The first leg has a flared lower end **77** extending in all horizontal directions past the vertical sleeve **62**. Any residual drops on the inside surface of the first leg of the U-shape pipe **76** after the stream **23** stops flowing merely flow down the inner lower face of the first leg where they drip off the lower edge of the flared leg portion **77** into the trough **61**.

All of the redirected portions of streams **23** captured by the devices **60**, **70**, **70**' and **75** of FIGS. **4**B, **5**, **6** and **7** are of lower energy and are kept by these devices from dropping back through the central entry apertures for streams **23** in sleeves or dams **62**.

The drip guide in FIGS. **8**, **8**A and **9** is an annular stainless steel screen member **78** that is bonded to an annular plastic PVC ring which is in turn bonded to the outer surface of the PVC diverter **35** around its entrance opening. The screen **78** is deformed like the brim of a cowboy hat. At the sides where the split streams **20**A and **20**B pass this drip guide, as seen in FIG. **3**B, the screen edges are turned up to assure more clearance for the split streams. At 90° from these bent up sides the screen is turned down and provides lowest drip points outwardly beyond the opening in the diverter **35** through which the unsplit jet stream **23** passes. (See FIGS. **8**, **8**A and **9**) FIG. **9** shows the screen from the underside. Water on the upturned screen portions flows around to the downwardly bent sides. The screen **78** not only is adjustable for optimum shape, but also is of **16** mesh which because of surface tension of water does not permit low energy droplets to pass through the screen.

The drip guide of FIGS. **10**–**12** is a bead **79** of PVC plastic bonded to the surface of the PVC diverter **35** to form a raised rib with drip projections **79**' at the lowest point to prevent low energy droplets from moving down the conical surface of the diverter toward the entry opening for the stream **23**.

FIG. **13** shows a structure of multiple laminar flow liquid stream nozzle devices having at least two banks of oppositely located spaced receptacles with essentially linear laminar flow stream patterns each projected unidirectionally from a nozzle device in one receptacle to a stream receiver in another receptacle.

FIG. **13** illustrates an eye-catching display system structure **80** having a supporting framework including a lower tank **81**, an upper trough or tank **82** and two hollow supporting column structures **83** for supporting the tank **82** directly over tank **81**. Within tank **81** there are four nozzles like nozzle **10** of FIGS. **3**, **3**B and **4**A using the shield **40**', with their axes vertical for upwardly projecting the vertical laminar flow jet streams U1, U2, U3 and U4. These streams are projected through holes in a decorative grid **85** from nozzles hidden below the grid **85** and anchored in the bottom of tank **81**. The upwardly projected laminar flow streams U1, U2, U3 and U4 are diverted and captured within tank **82** by catching, diverting and restraining devices such as seen in FIGS. **4**B and **5**–**7**. Within tank **82** are four inverted nozzles for vertically downwardly projecting the laminar flow jet streams D1, D2, D3 and D4. These nozzles are also like nozzle **10** of FIG. **3** and are rigidly supported in tank **82** to project the streams D1–D4 down through vertical sleeves (like sleeves **62** of FIGS. **4**–**7**) sealed in the bottom of the tank **82**. These inverted nozzles can be mounted by sliding the outlet sleeve **29** over a sleeve (like sleeve **62** in trough **61** of FIG. **4**B) in the bottom of the tank **82**.

Other variations within the scope of this invention will be apparent from the described embodiment and it is intended that the present descriptions be illustrative of the inventive features encompassed by the appended claims.

What is claimed is:

1. A stream generating device for projecting a vertical laminar flow liquid stream comprising a canister having a liquid inlet port for connection of the device to a source of liquid at a uniform pressure and flow rate, said canister having a stream defining port, means within the canister for eliminating turbulence in liquid flowing under uniform pressure and flow rate from said source through said canister between said inlet port and said stream defining port, said stream defining port being round and having a sharp edge to form a laminar flow stream of said liquid projected continuously from said stream defining port, said device having means defining an outlet port aligned along a common axis with said stream defining port to pass said laminar flow liquid stream for projection along said axis beyond said device, diverting means between said stream defining port and said outlet port for selectively diverting said liquid stream within the device to prevent any of the liquid in said laminar flow liquid stream from passing through said outlet port,

said device being oriented with said axis essentially vertical with the stream projected upwardly,

a catching chamber having means defining a downwardly facing aperture to receive the upwardly directed liquid stream,

diverter means within said chamber for redirecting the stream along a path within the chamber to prevent any liquid from the stream from falling back along the path of the stream between said downwardly facing aperture and said outlet port, and means for returning redirected liquid from said chamber to said liquid source.

2. A stream generating device according to claim **1** wherein the diverter means is an inverted cup having peripheral walls for guiding the redirected liquid away from said downwardly facing aperture.

3. A stream generating device according to claim **1** wherein the diverter means is an inclined plate with a lower surface for guiding the redirected liquid away from said downwardly facing aperture and having a lower drip edge located horizontally beyond the downwardly facing aperture.

4. A stream generating device according to claim **1** wherein the diverter means is an inclined plate with a lower concave surface for guiding the redirected liquid away from said downwardly facing aperture and having a lower drip edge located horizontally beyond the downwardly facing aperture.

5. A stream generating device according to claim **1** wherein the diverter means is a scoop member with a curved surface for guiding the redirected liquid away from said downwardly facing aperture and having all lower drip edges located horizontally beyond the downwardly facing aperture.

6. A stream generating device according to claim **1** wherein the diverter means is a conduit with a downwardly facing flared inlet end for receiving said laminar flow stream and having a discharge end for guiding the redirected liquid away from said downwardly facing aperture, said flared inlet end having a lower peripheral drip edge located horizontally outside the downwardly facing aperture.

7. A jet stream device for projecting a laminar flow water jet stream comprising a canister having a water inlet port for connection of the device to a source of water at a uniform pressure and flow rate, said canister having a water jet steam defining port, means within the canister for eliminating turbulence in water flowing under uniform pressure and flow rate from said source through said canister between said inlet port and said jet stream defining port, said jet stream defining port being round and having a sharp edge to form a laminar flow jet stream of said flowing water projected continuously from said jet stream defining port, said device having means defining an outlet port aligned along a common axis with said jet stream defining port to pass said laminar flow water jet stream for projection along said axis beyond said device, diverting means between said jet stream defining port and said outlet port for selectively diverting said water jet stream within the device to prevent any of the water in said laminar flow jet stream from passing through said outlet port,

said diverting means comprising means selectively activated to split said laminar flow jet stream into two divergent streams to pass on opposite sides of said outlet port,

collecting means for collecting the water from said divergent streams for return to said water source,

said outlet port defining means having curved progressively increasingly separated divergent outer surfaces to be engaged by said divergent streams after passing on opposite sides of said outlet port for smoothly guiding said divergent streams outwardly with respect to said axis and into said collecting means.

8. A jet stream device according to claim **7** wherein the means defining said outlet port is a flared cone.

9. A jet stream device according to claim **7** wherein the means defining said outlet port is made of polyvinyl chloride.

10. A jet stream device according to claim **7** wherein the means defining said outlet port is a cone having on its outer surface drip guide means to prevent water drops on said outer surface from dropping into the path of and disturbing the normal flow of the laminar flow jet streams from said stream defining port to said outlet port.

11. A jet stream device according to claim **10** wherein the drip guide means comprises raised ribs on opposite sides of the cone.

12. A jet stream device according to claim **10** wherein the drip guide means is an annular screen member encircling the outlet port.

13. A structure of multiple laminar flow liquid stream nozzle devices having at least two banks of oppositely

located spaced receptacles with essentially linear laminar flow stream patterns each projected unidirectionally from a nozzle device in one receptacle to a stream receiver in another receptacle.

14. A structure according to claim **13** comprising multiple liquid stream nozzle devices projecting vertical parallel streams between a lower bank and an upper bank.

15. A structure according to claim **13** wherein each bank includes a tank for capturing spent water at the respective bank.

16. A structure according to claim, **15** including means for liquid transfer between said tanks and pump means in only one tank for providing pressurized liquid to all nozzle devices.

17. A structure according to claim **16** including means for moving all spent water from each nozzle device to said one tank having said pump means.

18. A structure according to claim **13** wherein each bank has stream projecting nozzles.

19. A structure according to claim **13** wherein one bank has nozzle devices projecting jet streams vertically upwardly.

20. A structure according to claim **13** wherein one bank has all its nozzle devices projecting jet streams vertically upwardly.

21. A capturing receiver for a relatively non-divergent essentially unidirectional vertically upwardly directed liquid stream, said receiver including a catching chamber having means defining a downwardly facing aperture to receive the upwardly directed stream, diverter means within said chamber for redirecting the stream along a path away from the aperture, and including means providing a flow path for redirected low energy liquid within the chamber which directs such low energy liquid away from the aperture.

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